The Stratigraphy and Palaeontology of Teapot Creek, MacLaughlin River, NSW

LEANNE ARMAND[1,2], W. D. L. RIDE[1] AND GRAHAM TAYLOR[3].

[1]Department of Geology, Australian National University, Canberra, ACT 0200;
[2]Current contact address: Institute of Antarctic and Southern Ocean Studies, University of Tasmania, GPO Box 252-77, Hobart 7001, Tasmania, Australia (Leanne.Armand@utas.edu.au);
[3]Cooperative Research Centre for Landscape Evolution and Mineral Exploration, University of Canberra, ACT 2601.

Armand, L., Ride, W.D.L. and Taylor, G. (2000). The stratigraphy and palaeontology of Teapot Creek, MacLaughlin River, NSW. *Proceedings of the Linean Society of New South Wales* **122**, 101-121.

The stratigraphy and the Quaternary depositional history of Teapot Creek, a tributary of the MacLaughlin River in the Southern Monaro, southeastern New South Wales, are given and discussed. Other fossil-mammal bearing deposits in the MacLaughlin Valley are reported.

The valley of Teapot Creek contains a sequence of terraces. The highest and oldest of these is characterised by poorly sorted conglomerate deposits typical of stream-deposited longitudinal bars. Palaeomagnetic results obtained from this terrace are interpretable to the Bruhnes normal polarity interval (<0.78 Ma). A second, lower terrace is set into the highest terrace. Deposition of this terrace began before 5320±80yr BP and is characterised by overbank deposits. The lowest and youngest terrace, consisting mostly of fine clays and silts, represents lateral accretions inside meander loops during modern flooding events.

The youngest terrace contains the remains of modern introduced mammals. The intermediate terrace has yielded fossils of modern *Macropus* and an unidentified murid. The highest terrace contains the remains of fossil mammals found in Plio-Pleistocene fossil deposits elsewhere in Eastern Australia. Species identified from it are *Macropus altus, M. ferragus, M. titan, Procoptodon goliah, P. pusio, Protemnodon anak, P. "roechus/brehus", Sthenurus atlas, S. occidentalis, S. newtonae, Troposodon minor,* and *Phascolonus gigas,* but no modern species of *Macropus* kangaroos or wallabies.

Pleistocene fossil mammals have been located in four other sites in the valley of the MacLaughlin River. A fifth site, Chalk Pool, is sedimentologically different and at a lower level relative to the modern river than the other terraces. Species identified in the Chalk Pool deposit are regarded as Plio/Pleistocene forms (*Macropus pan*, *Protemnodon chinchillaensis* and *P. "roechus/P. brehus")*; of these, *P. chinchillaensis* is known only from the Pliocene.

Manuscript received 1 July 2000, accepted for publication 13 November 2000.

KEYWORDS: Chalk Pool, Macropodidae, Marsupial, Monaro, Pleistocene, Pliocene, Teapot Creek, Vombatidae.

INTRODUCTION

Background

The Monaro region is the highest part of the southern tablelands of New South Wales. Work on mammal fossils from alluvial deposits in the region has previously been confined to a study on the northern part of the region (Ride et al. 1989; Davis 1996; Ride and Davis 1997), although in the 1930's fossil mammal remains had been collected from a gravel pit at Jincumbilly in the southern Monaro (Australian Museum specimens and local press reports). More recently, in 1987, students of the University of Canberra, engaged in geological mapping in the region, reported finding a large bone fragment (a diprotodontid) in Bungarby Creek on Brooklyn Station and macropodine fossils in Teapot Creek on Sherwood and Boco Stations (Fig. 1). Further studies of Teapot Creek were made principally by the first author (Dansie 1992). During these studies a further four sites were located, close by in the valley of the MacLaughlin River, of which Teapot Creek is a tributary.

In this paper, a study of the stratigraphy and palaeontology of Teapot Creek is presented. Two ^{14}C dates are recorded for the intermediate terrace of Teapot Creek, and a palaeomagnetic result for the highest terrace. The other localities and their fossils are also listed briefly and their relationship to the Teapot Creek deposits is discussed.

General description

Basalts of Paleocene to Oligocene age dominate the valley of the MacLaughlin River (K-Ar dates of 51±0.3 and 37.2±1.0 Ma, Taylor et al. 1990; Roach et al. 1994). These overlie lacustrine sediments. The basalts provide the principal source material for the Quaternary hillslope (colluvial) and alluvial deposits of the valley. The basalts, which are also the basement rocks at the Quaternary and Holocene fossil sites described here, are considered to have been derived locally from multiple eruption sites. Teapot Hill, close to the junction of Teapot Creek and the MacLaughlin River is one of these eruption sites (Roach 1991; Roach et al. 1994) (Fig. 2).

The lacustrine sediments which underlie the basalts are believed to represent the western edge of a palaeolake (Lake Bungarby, Taylor et al. 1990). These sediments are thought to be the source of quartz sands and pebbles found as a rarer component in some of the post-basaltic deposits.

Similar sub-basaltic lacustrine deposits occur nearby in the valley of the MacLaughlin River. These contain a diverse fossil macroflora (Taylor et al. 1990; Hill 1991; Hill and Carpenter 1991; Christophel 1994) and on the basis of contained fossil pollen, have been assigned to the *Lygistepollenites balmei* Zone of the late Palaeocene (Taylor et al. 1990). The sediments underlying the basalts in Teapot Creek are thought to be extensions of the same deposits.

We infer that during the late Quaternary (<75 ka) the area was subject to periglacial conditions on several occasions. In the Kosciuszko region, recent moraine exposure dates have indicated an early glaciation phase at ~55-65 ka and a late glaciation period bewteen 15-35 ka with three progressively less extensive glacial advances occuring at 32,000 ± 2500, 19,100 ± 1600 and 16,800 ± 1400 years ago (Barrows et al. in press). Similar findings from glacial records are reported from the Tasmanian Highlands (Fitzsimmons and Colhoun 1991; Colhoun 2000). Sediments in the ACT reveal several periods of slope instability that are thought to indicate separate periods of periglacial climates in the south eastern highlands (Barrows 1995). In addition, the Monaro region lies in the rainshadow induced by the Australian Alps (Tulip et al. 1982; Ride et al. 1989). While the rainshadow may have ameliorated the effect of climate shifts, the late Quaternary was undoubtedly cooler and drier than at present with attendant higher sediment mobility. Under these climatic influences erosion and alluviation have shaped the valleys.

RESULTS

Geomorphology of Teapot Creek

The Teapot Creek catchment covers 7 km^2 on Sherwood Station, approximately 12 km south-west of Nimmitabel in the southern Monaro (Fig. 1). Teapot Creek rises as channels in the steep, hilly terrain of Sherwins Range at an elevation of 950 m, and over its length of 4 km, falls to below 780 m to a wide, gently sloping valley at its junction with the southerly flowing MacLaughlin River, the latter being a tributary of the Snowy

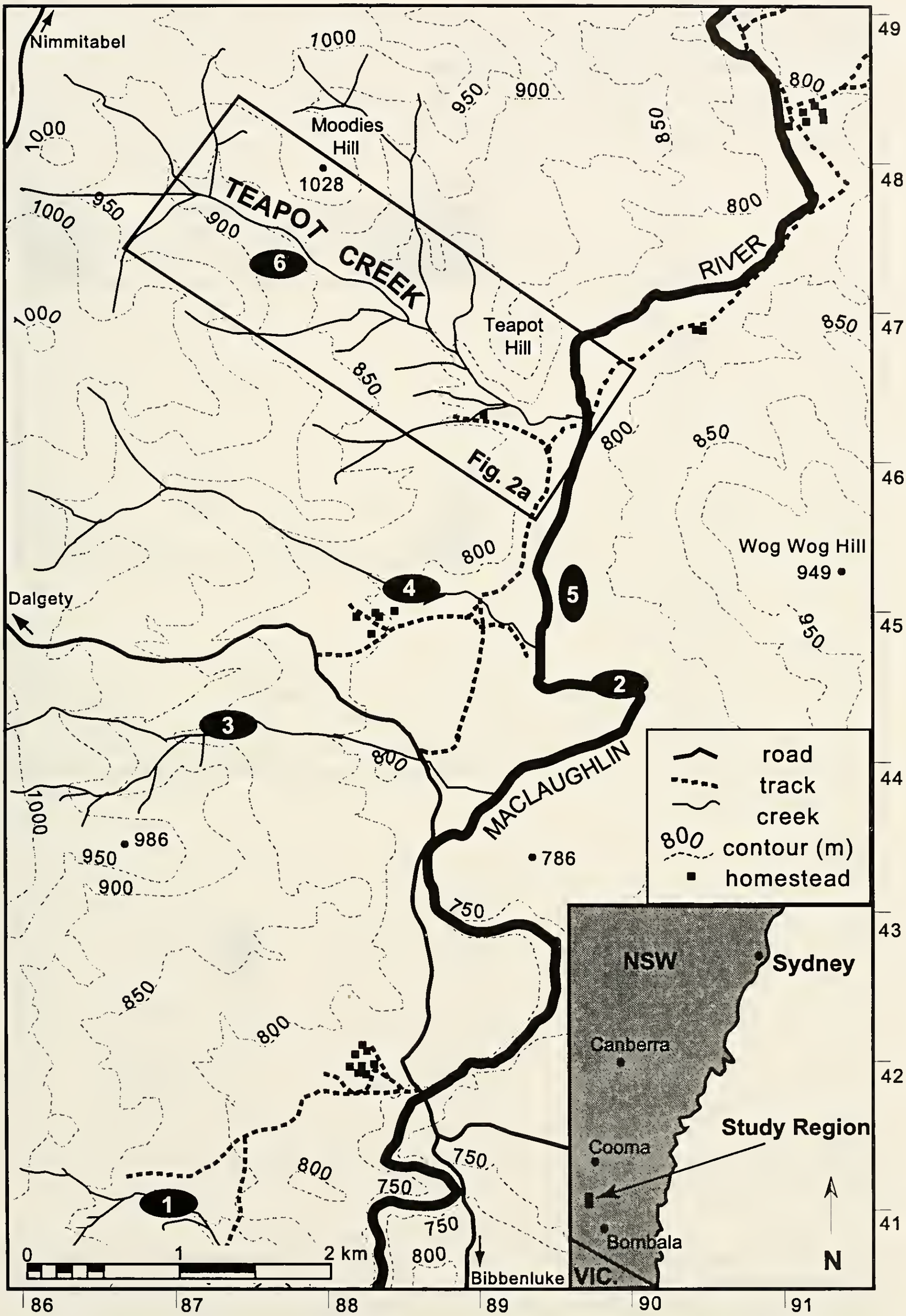

Figure 1. Topographic map indicating fossil sites and the Teapot Creek study area described in the text. Sites are identified as follows: 1= Bungarby Creek, Brooklyn Station, 2= Chalk Pool, 3= Toppings Creek, 4= Ben's Bin, 5= Railway Cutting, 6= Teapot Creek Study Area, enclosed by box. Sites 2 to 6 are located on Sherwood Station. Map reference scale: Australian Map Grid (U.T.M.) intervals of 1000 from Origin of Zone 55.

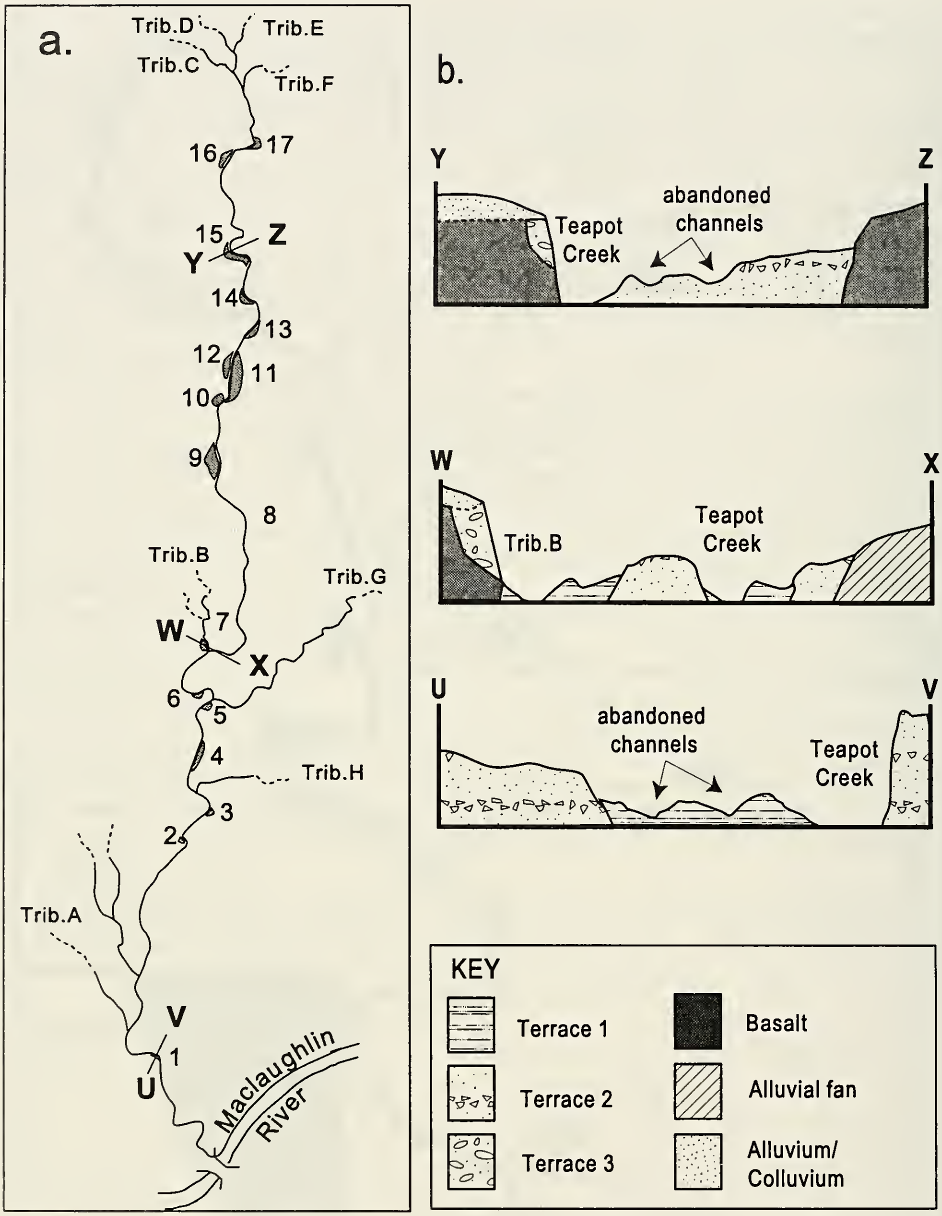

Figure 2a: Teapot Creek fossil localities described in text. 2b: Corresponding generalised cross sections of Teapot Creek (from 2a) illustrating alluvial terraces. Illustrations in 2b are not to scale.

River. The modern Teapot Creek flows down the north-eastern side of its valley where it incises a sequence of gently sloping alluvial plains. Lateral fans merge with these and are incised by small tributaries (Figs 1 and 2). The depth of incision by Teapot Creek decreases down stream from approximately 15 m to 2 m. Alluvial fans merge laterally with the alluvial plain along the lower valley, where current entrenchment of the stream shows some evidence of meandering prior to its present incision.

The fossil-bearing sites are located in banks exposed by the entrenchment of Teapot Creek. The modern creek is confined to a single major channel (approximately 1 m wide and about 50 cm deep). Flooding in the creek raises the water level up to 2 m. Currently, Teapot Creek is a sinuous stream which has low point-bars and thalweg deposits of basalt-derived gravel, sands and mud, and deep, steep entrenched banks. Basalt crops out in many places along the creek, even in the upper reaches, where entrenchment down to this level has produced well worn surfaces and minor pools.

Sequence and sedimentology of the Alluvial Terraces

Stratigraphic information for Teapot Creek valley was obtained from exposures in escarpments, cut stream banks, and four trenches excavated with a back-hoe. From the information gathered, terrace sequence was determined and an informal stratigraphy provided (Dansie 1992). There is no formal stratigraphy associated with the deposits of the Southern Monaro and the description of stratigraphy is hindered by the lack of superposition. Several facies are observed in each of the sedimentary units within exposures and their descriptions follow lithofacies defined by Miall (1977, 1978), and Rust (1978).

Three alluvial benches are identified along the length of Teapot Creek. These morphological terraces are inset within one another along tracts of the creek (see section W-X in Fig. 2b). Relative elevations and lithostratigraphic similarity of the exposed terraces determined correlation of the terraces along the creek. Figure 2b shows a generalised valley-fill sequence for Teapot Creek at three points of its length. Each terrace is composed of a single alluvial morphostratigraphic unit often overlain by colluvial and alluvial deposits, which has been derived from the valley sides and during flood events. The contact between the terrace deposits and the overlying colluvial/alluvial veneer varies from diffuse, in cases where intense pedogenesis has occurred, to sharp hiatus. The terraces all overlie a basalt basement, except at one site (Fig. 2a, site 5) where the terrace overlies a mixed quartz sand and basalt-derived clayey facies, considered to have been reworked from the Palaeocene lacustrine deposits and surrounding basalt material.

Terrace 3 is the highest alluvial deposit in the area. It is predominantly a fluvial deposit, containing crudely bedded conglomeratic units with weakly imbricated gravels. Each exposure of Terrace 3 (Sites 3 to 7, 9 to 12, and 14 to 17) has a unique internal facies sequence, but at all sites examined there is a comparable mix of facies consisting of: matrix supported, poorly bedded, medium- to coarse- grained well sorted channel gravels; and pebbly muds and very fine sands of overbank deposits. The conglomerate facies are predominantly basalt derived but include rare (< 1% of conglomerate composition) quartz and jasper pebbles indicating an Ordovician provenance for some material. Granite pebbles found at Site 7 indicate that material possibly derived from the Silurian aged Berridale Batholith, was available at the time of deposition. However, source areas for such older rocks are unknown in the present catchment. It is possible they are recycled from pre- and intra-basaltic alluvial deposits, which are common throughout the Monaro. Soils on Terrace 3 vary from 5 cm to 370 cm in thickness, and have an average thickness of 60 cm They comprise a dark, yellowish brown clay with discrete calcrete nodule layers. In instances where the soils have been eroded, these calcrete bands are exposed on the surface.

Multiple channel deposits are common within Terrace 3, indicating that they represent a long period of deposition. Terrace 3 sites include the bulk of the stratigraphic sections investigated (Fig. 2). Site 13 is thought to represent Terrace 3, but it occurs out of stratigraphic context on top of a 15 m high escarpment, and in addition its sediment characters remain undetermined due to its inaccessibility.

At the time Terrace 3 was deposited, Teapot Creek was a braided stream comparable to the Scott type (proximal braided stream) of Miall (1977, 1978, 1982), which is indicative of scour-based, massive conglomerate beds overlain by sandy facies that are then scoured by superimposing bars. The cyclicity in the Terrace 3 deposits is interpreted as recording rapid aggradation from flooding events. The braided stream is estimated to have been 40-50 m wide in the upper reaches of the creek (Sites 15 and 11, Fig. 2a), which had decreased in breadth to around 15-20 m at Site 7 (Fig. 2a).

Terrace 2 is distinguished from Terrace 3 by its lower elevation and by black-coloured fine-grained sediments and conglomeratic channel deposits. The colour is the result of a high organic content. At sites 1 and 2 (Fig. 2a), Terrace 2 shows fining upward sequences of finely laminated clays, silts and sands, and low angled cross-bedded coarse- to fine-grained sands. Both facies indicate a stream that developed a significant flood plain with waning flow. The overbank deposits increase in thickness up-sequence, and contain charcoal deposits, and evidence of bioturbation. Conglomeratic deposits are generally of well-rounded and sorted basalt clasts. The area of deposition of Terrace 2 decreases upstream in Teapot Creek as the valley decreases in width and depth and the entrenchment of the creek increases. The terrace is also found in tributaries of Teapot Creek but similarly disappears upstream. Soil development on the surface is up to 37 cm deep and is composed of basalt-derived black clays.

Terrace 1 is the lowest terrace and occurs on the inside bends of meander loops, where it forms lateral accretion deposits of fine clays and silts. It is very young by comparison with Terrace 2 and contains remains of modern species introduced by Europeans. Terrace 1 occurs upstream of Site 8 (Terrace 2) and along most tributaries in the study area. It is covered in places by recently deposited flood debris. Chute channels often cross some of the Terrace 1 benches down stream in the open valley (abandoned channels in Fig. 2b.) Minimal black clayey soil development occurs at the surface of these terraces, having a maximum depth of 10 cm, which is frequently disturbed by modern flooding events. Such development is termed stratic: a low alluvial bench frequently flooded, of raw, pedologically unmodified alluivium that is encompassed by alluvial soil classification (Walker and Coventry 1976: 307).

Terrace chronology

Terraces 1 and 2 both occur close to the stream bed, Terrace 1 in the downstream reach and Terrace 2 farther upstream. Terrace 3 occurs well above Terraces 1 and 2 (Fig. 2b). Progressive lowering of the alluvial landscape, producing these younger inset terraces, relates to the reduction of stream discharge due to late Quaternary change in climate. Charcoal and sediment from one stratigraphic 'bed' (Fig 2a, site 2) were obtained and sent to Beta Analytic Inc. (Florida, U.S.A.) for dating. Two carbon dates at a approximate depth of 550 cm and 560 cm, provided ages of 4940±140 BP (TPC/B/1- Beta-50156, charcoal) and 5320±80 BP (TPC/B/2-Beta-50157, sediment) respectively. Thermoluminescence dates were not obtainable from the fluvial deposits of Teapot Creek because the deposits lack sufficient quartz material and no molluscan remains were encountered, thus eliminating the possibility of delta^{18}O analysis.

Terrace 3 is predominantly composed of channel deposits and occurs high in the landscape relative to Terrace 2. Palaeomagnetic samples were taken from fine-grained facies within fossil-bearing Terrace 3 conglomerate beds at Sites 4 and 15 (Fig. 2a). These samples were then step-wise alternate field demagnetised and measured on a Molspin spinner magnetometer at the joint AGSO/ANU Palaeomagnetic Laboratory, Black Mountain, Canberra. Palaeomagnetic results indicate a normal polarity for fine-grained facies from these sites, which although not conclusive, is interpretable to the Brunhes normal polarity interval (<0.78 Ma) (B. Pillans pers. comm. 1996).

Teapot Creek fossil mammals: identification and physical condition

From the Teapot Creek study area (Fig. 1, no. 6) 244 fragmentary specimens of fossil mammals were collected between 1988 and 1995. Of this total only 62 specimens have been identified to family, and only 42 to species. Of the latter, all but *Macropus titan* are sparsely represented (in some cases only by a few parts of broken molars).

The probable causes of the fragmentation include transport by water and post-depositional weathering by episodic clay expansion and contraction, and also calcrete impregnation. There does not seem to be any evidence of bite marks on the bone. There is little evidence of bone mineralisation, but partial 'opalisation' is noted in some of the teeth recovered.

Species identifications of the fragmentary material are presented here on the basis that each specimen is not morphologically separable from an equivalent part of a securely identified specimen of the species named (preferably the holotype or a topotypical specimen). To enable the identifications to be evaluated by subsequent workers, each species listed is accompanied by the number and a brief description of the specimen(s) on which the species identification principally depends (the voucher specimens), the collection number of the museum specimen with which it was compared, and a bibliographic reference to a description of the diagnostic characters. Voucher specimens for all taxa identified are deposited in the Australian Museum, Sydney.

All taxa listed above were identified by the senior author and Ride; the latter then visited museum collections and made direct comparisons with identified specimens (and wherever possible with types and topotypical specimens). Comparisons with Sthenurinae were confirmed for us by Dr G. Prideaux.

No formal faunistic name is given in this work to the species assemblages reported from the three terraces (the species assemblage of Terrace 3 deposits has previously been referred to by Dansie (1992) as the Teapot Local Fauna).

Taxonomic attributions to genera are those adopted in Ride et al. (1989). *Macropus titan* and *M. altus* are both morphologically distinct from *M. giganteus* and *M. robustus* and are conventionally treated as full species. The use of the names *Procoptodon* and *P. pusio* are maintained as cases under consideration by the International Commission on Zoological Nomenclature, in accordance with Article 82.1 of the International Code of Zoological Nomenclature (Davis and Ride 2000).

Fossil occurrences in the Teapot Creek Terraces.

Fossil mammals recovered from each of the three Terraces are listed in Table 1. Terrace 1 contained only the remains of modern introduced species. Terrace 2 deposits (Site 2) have yielded three fossils only. Of these, only part of a pelvis has been identified to a genus (*Macropus*). The presence of a species of the modern kangaroo (*M. giganteus* or *M. robustus*) in the deposit, which has a probable minimum age of between 4660 and 5480 BP (see above), is consistent with the presence of modern species of *Macropus* in similarly dated deposits in the northern Monaro (Ride et al. 1989; Davis 1996).

All other fossils in the Teapot Creek valley were recovered from Terrace 3 deposits. Many fossils were collected at sites from which they had weathered out, but others were excavated directly from within the deposits; those excavated were found predominantly within conglomeratic facies and, less frequently, in overbank and sandy point-bar facies. The overbank and sandy point bar facies yielded the least damaged fossils, yet such facies were rare in Terrace 3 deposits (being confined to Site 4) and, even in those facies, the bone structure was cracked by clay expansion and desiccation. As a result, it is very unlikely that fossil material would have been reworked from Terrace 3 to Terrace 2 deposits without disintegrating. No fossils in that condition were found in Terrace 2.

Specimens collected from the surface in the valley of Teapot Creek by students and others mapping in the area are all attributed by us to Terrace 3 deposits. Information given by the donors satisfied us that all came from upstream of the Site 2 (Terrace 2). Identifications of these are recorded after the site records under the heading "Terrace 3 - unlocalized".

Other fossil sites in the valley of the MacLaughlin River

Five other alluvial sites in the valley of the MacLaughlin River, southern Monaro, have yielded fossil mammals (Fig. 1: Ben's Bin, Railway Cutting, Toppings Creek, Chalk Pool, and Bungarby Creek – the first four are within Sherwood Station and the last is on Brooklyn Station).

At Ben's Bin, Railway Cutting and Toppings Creek sites the fossils are eroding from cut banks. The fossils are very fragmented and disassociated, and all identifications

Table 1. Species lists of Teapot Creek Sites by Terrace and site affiliation. The number of specimens, whether identifiable or not, from each site is provided in column 2 and includes bundled collections of bone shards recovered from the sites. A complete index of the specimens and material collected is found in Dansie (1992). Species taxonomy (authorship and dates) of the species listed in Table 1 is formally treated in the Appendix.

Sites	No. specimens recovered	Specimens identified to species level
Terrace 1		
Between Sites 1 and 8	not recorded	*Vulpes vulpes*
		Bos taurus
		Ovis aries
Terrace 2		
Site 1	0	
Site 2	3	*Macropus* (either *giganteus* or *robustus*)
Terrace 3		
Site 3	2	
Site 4 to 6	28	*Macropus titan*
		Protemnodon anak
		Protemnodon "roechus/brehus"
		Procoptodon goliah
		Sthenurus occidentalis
		Troposodon minor
Site 7	21	*Phascolonus gigas*
		Protemnodon anak
		Procoptodon pusio
		Macropus titan
		Macropus ferragus
Site 9	5	*Macropus titan*
Site 10	3	
Site 11	3	*Macropus titan*
Site 12	10	*Sthenurus newtonae*
Site 14	12	*Macropus titan*
Site 15	8	*Macropus titan*
		Macropus ferragus
Site 16	13	*Macropus titan*
Site 17	2	*Macropus titan*
		Macropus altus
Terrace 3 - unlocalised	35	*Protemnodon "roechus/brehus"*
		Macropus titan
		Macropus ferragus
		Sthenurus atlas

are based on isolated teeth or fragments of teeth and a few more complete dentitions (such as several from Toppings Creek). On the basis of the fossils the ages of these three sites are not different from Terrace 3 sites in Teapot Creek and the deposits are either remnant point-bar sequences or conglomeratic thalweg deposits.

An exposure at Chalk Pool, on the MacLaughlin River, close below its junction with Teapot Creek (Fig. 1), is significantly different from other sites in the region. The site occurs at lower elevations (between 750 and 760 m) than any other fossil site in the MacLaughlin River valley. Here the fossils are also contained in point bar or conglomerate facies. Material from the point bar is encased in a 2-4 cm thick calcareous shell of orange coloured, medium-sized sand grains. Jaws that contain portions of molar rows and partial long bones have been recovered. Fossils of at least three species are identified and all are known from the Plio-Pleistocene elsewhere (one only from the Pliocene).

Two fossil post-cranial fragments have been recovered from a site in Bungarby Creek, on Brooklyn Station - also a largely conglomeratic deposit. Neither specimen has been identified to species, although one is certainly a large diprotodontid. Although attempts at locating other fossil-bearing deposits in the vicinity on Brooklyn Station have been made, no other fossils or likely sites have been located. The species from these sites are listed in Table 2.

DISCUSSION

Interpretation of fossils

All but one species of fossil mammal (*Phascolonus gigas*, the giant wombat), recovered so far from Terrace 3 deposits of Teapot Creek are Macropodidae (kangaroos and wallabies, and short-faced kangaroos). Eleven species of four macropodid genera are represented. The most common is *Macropus titan*; the other species comprise less than 35% of individuals identified (i.e., *Macropus altus, M. ferragus, Procoptodon goliah, P. pusio, Protemnodon anak, P. "roechus/brehus", Sthenurus andersoni, S. atlas, S. occidentalis, S. newtonae, Troposodon minor*). From Murray's estimates of weights of fossil mammals (Murray 1991:1155 - 56, tables 16, 17) most, when adult, would have been between 50 and 100kg in weight. Because all other Pleistocene fossil deposits in the Eastern Highlands (including the northern Monaro - see Ride et al. 1989) contain numbers of smaller species, the composition of the fossil sample indicates that the processes responsible for its accumulation in the Terrace 3 deposits were highly selective, either at death or post-mortem (or both); it is not possible, at this juncture, to determine which of the two (or both) occurred.

The condition of the specimens indicates that they are derived from earlier accumulations. No specimens are articulated and all are fractured, probably the result of their having been transported. But nothing indicates that they are significantly older than the sediments, or that more than a short period of time is represented by them. We have been unsuccessful in obtaining any dates from the fossils themselves. We attempted to have collagen dated from fossil bone collected from Terrace 3 (Site 7), but the dating laboratory found that "the collagen fraction (basal bone protein), which is very susceptible to decay when exposed to nature's weathering mechanisms, has decayed away entirely (or almost entirely)" (in litt. Beta Analytic Inc., 2 April 1993).

No species in Terrace 3 deposits is represented by sufficient individuals to provide a reliable statement of the distribution of mortality in the population. However, the most numerous species, *Macropus titan* (26 identified individuals), allows some tentative interpretation of, at least, whether it represents a random sample of a stable breeding population. In the probably closely-related species, *M. giganteus,* the age of individuals may be established from molar progression (molar index; Kirkpatrick 1964, 1965a). In the sample of *M. titan*, no specimens are sufficiently complete to enable molar progression stages to be measured directly by Kirkpatrick's method, but the crown wear of molars enables stages of dental eruption and dental progression to be inferred assuming that

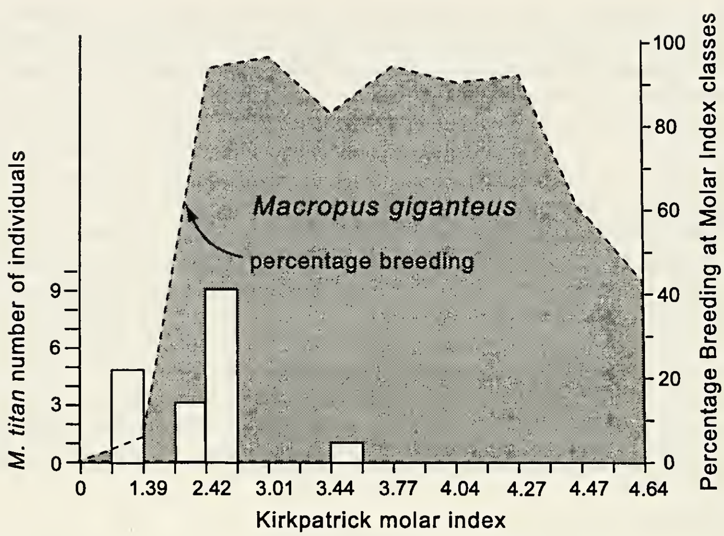

Figure 3. Histogram of molar indexes of individuals of *Macropus titan* in the Teapot Creek, Terrace 3 deposit, shown against a graph indicating the percentage of breeding females at the same molar indexes in the closely related species, *M. giganteus* (data of *M giganteus* from Kirkpatrick, 1965b; 50% of

wear follows the pattern observed in *M. giganteus* (details of the method, and justification for it, are to be published by Ride and A.C. Davis in a work on the Quaternary vertebrate fauna of Pilot Creek, near Cooma, N.S.W.). Estimates can be made of molar index from 17 of the 24 specimens.

The pattern inferred from the *Macropus titan* sample from Terrace 3 (Fig. 3) indicates that most individuals died after M2 had erupted, and before the dentine was fully exposed across both lophs (-ids) of M4. In the case of modern *M. giganteus*, individuals of that age are actively breeding adults (Kirkpatrick 1965b - i.e., individuals with a molar index between 1.39 and 4.6). This conclusion is comparable with those recorded by Gillespie et al. (1978:1046); and Flannery and Gott (1984:413) for samples obtained from the Pleistocene Lancefield Swamp and Spring Creek deposits. Although these authors conclude that a more aged part of the adult population is represented in their samples compared with that from Pilot Creek. We are unable to comment on the difference, but such narrow and unimodal distributions of deaths revealed by all three populations would be unexpected if they were stable mammal populations with long breeding lives undergoing progressive mortality. In such cases, the remains of juvenile and aged animals are expected to predominate in samples (especially juveniles - for the interpretation of age distribution from similar samples, see Ride and Tyndale-Biscoe 1962; Hughes 1965; Flannery and Gott 1984; Turnbull and Martill 1988). Since the sample reveals neither a distribution pattern suggesting progressive mortality in a stable population, nor one resulting from a catastrophic occurrence (such as a flash flood), either the age structure of the population was disturbed irregularly as to annual increments, or some selective agent resulted in juvenile and aged classes (particularly the juvenile) to be under-represented in the sample.

The Teapot Creek accumulation also displays a strong bias in favour of the representation of larger mammal species as does the Lancefield deposit (see Van Huet 1999:338-9). At Lancefield, the remains of small mammal species are present but they are comparatively rare (there, only 24 of 317 individuals are of species smaller than *M. titan* which is represented by 263 individuals; other megafauna in the Lancefield deposit, comparable with or larger than *M. titan*, are *Diprotodon, Zygomaturus, Procoptodon, Sthenurus* and *Protemnodon*).

Having obtained from the skeletal remains substantially older dates than those obtained from the underlying deposit, Van Huet (1999) established that the assemblage was reworked from an earlier deposit. She has concluded that the biased faunal composition observed in the assemblage need not have been the result of the operation of a selective agent at time of death (such as human predation), but that post mortem sorting is an equally plausible cause of the atypical population structure observed.

In summary, the taphonomic and stratigraphic observations from the Terrace 3 deposits reveal, in combination, that the likely depositional scenario for fossil material in the conglomerates is that they were sorted and deposited by flood waters sweeping into and through the valley from Sherwins Range. The waters would have moved along exposed channels and overbank deposits in which animal remains had previously accumulated. The by then disassociated and further fragmented remains were then water-sorted and accumulated in the conglomerate bedforms which were laid down in the high flow regime. Reworking is thus considered by us to have been an integral part of the fossilisation history of the material.

Age of the fauna

Site 2 at Teapot Creek, dated between 4940 and 5320 years BP, provided us with minimum ages for Terrace 2 deposits. As noted previously, these ages are comparable with those of late Holocene northern Monaro, Pilot Creek, sequences (Ride et al. 1989) which also contain fossil *M. giganteus* and no *M. titan* (Ride et al. 1989; Davis 1996).

The species found in the Terrace 3 deposits are typical of those occurring widespread in Pleistocene mammal faunas (e.g., eastern Darling Downs) but, because too few accurately dated Pleistocene mammal local faunas have been described from ecologically comparable sites in eastern Australia, it is not possible to assign the sample to a stage within the Pleistocene. However, the fact that no modern species of *Macropus* (neither *Macropus* nor *Notamacropus*) has been identified in the sample with otherwise predominantly Pleistocene species (see Dawson, 1982, p.233, 1985, p.63), suggests possible equivalence with the Bone Cave local fauna of Wellington Caves with which it also shares species (i.e., *M. titan, M. ferragus, M. altus, Protemnodon anak, P. brehus* and *Sthenurus atlas*). Currently, the sample is small but if further sampling of the Teapot Creek deposit supports the absence of modern species of *Macropus*, the two deposits will be unlike any other described Pleistocene deposit in the Eastern Highlands of New South Wales with strong biostratigraphic significance.

On faunistic grounds the Bone Cave assemblage is currently believed to be mixed, but encompassing the Late Pliocene/ Early Pleistocene, or the "early Pleistocene ?" (Dawson, 1995, Dawson et al, 1999), but Fischer (1999) has presented results of analyses of a flowstone underlying the Mitchell Cave Beds. These analyses by several methods yielded dates of <1.5 Ma ($^{234}U/^{238}U$), <350 ka ($^{230}Th/^{234}U$) and ~272 ± 4 ka (mass spectrometric analysis). Fischer also states that the normal magnetic polarity "of the deposit" (i.e., the Mitchell Cave Beds) strongly suggests deposition during the Brunhes polarity chron (i.e., younger than 0.78 Ma). Stratigraphic data confirming the relationship of the flowstone sample examined by Fischer, with the Bone Cave deposits and, in particular with the Mitchell Cave Beds (containing the Bone Cave local fauna), are as yet unpublished.

Macropus titan occurs widely throughout the Terrace 3 deposits, where it is the commonest species, but this does not necessarily indicate a Pleistocene age for the deposits because *M. titan* occurs, although rarely, in Pliocene deposits as well (Bartholomai 1975:199; Dawson and Flannery 1985:482); but in the context of the Terrace 3 fauna, it is most likely that it does so. The occurrence of *M. titan* is unlikely to indicate a Holocene age for the deposits. The species occurs in dated Pleistocene deposits until at least before the last glacial maximum (26ka at Lake Menindee, NSW, Marshall 1973; Bartholomai 1975, initially recorded as *M. ferragus*; Tedford 1967); in the northern Monaro, it disappeared from the fauna of Pilot Creek between 25 and 11 ka (Ride et al. 1989; Davis 1996).

The species of *Protemnodon, P. anak* and *P. "roechus/brehus"* in Terrace 3 also occur in undated, but faunistically and stratigraphically Pleistocene sites in the eastern Darling Downs, Queensland (Bartholomai 1975; Molnar and Kurz, 1997) as well as in the late Pleistocene in the northern Monaro (Ride et al. 1989; Davis 1996). So far as is known, the genus *Procoptodon* is solely of Pleistocene age (Prideaux and Wells 1997:194). Of the two species in the Terrace 3 deposits (*P. goliah* and *P. pusio*), *P. goliah* has been recovered from Late Pleistocene deposits in the Eastern Highlands, at Lake George with a probable age of between 21 and 27 ka (Sanson et al. 1980). The species of *Sthenurus (S. atlas, S. newtonae, S. occidentalis*), although also represented by very little material, support the Pleistocene comparison exemplified by eastern Darling Downs faunas.

The distinctive Chalk Pool fauna containing *Protemnodon chinchillaensis, P. "roechus/brehus"* and *Macropus pan* contrasts with any assemblage from Teapot Creek. Both *P. chinchillaensis* and *M. pan* are known from the early to middle Pliocene Chinchilla Sands (Bartholomai 1973, 1975). *Macropus pan* has also been recorded from a deposit at Quanbun Station, Fitzroy River, Western Australia (Flannery 1984). When first described, the Quanbun deposit was thought to be Pleistocene (Glauert 1921, 1926), and later, because of the presence of *M. pan* together with a large species of *Protemnodon* (identified by Flannery as *P. roechus*) became regarded as Plio-Pleistocene (Flannery 1984; Rich et al. 1991:1048). On this basis it seems likely that the age of the Chalk Pool deposit lies between the Early to Middle Pliocene (Bluff Downs/Chinchilla, Rich et al. 1991:1041, 1047) and possibly the Early Pleistocene (Quanbun).

Palaeoclimate and faunal setting

Alluviation in Teapot Creek is thought to have begun in the Pliocene as a result of changes in the climate. Australia experienced seasonal aridity from the late Miocene - early Pliocene (5-6 Ma) (Bowler 1982). The rainshadow affect was already considered to be in place (Tulip et al. 1982) suggesting that flooding occurred in the summer months rather than winter. Costin (1954) interprets the effect of the rainshadow to have increased the incidence of erosion. Minimal soil development on the southern Monaro lake basins, since 2 Ma, may verify this hypothesis (Pillans and Walker 1995). Lake George records indicate that weathering, deposition and landscape instability lasted into the late Pliocene (Bowler 1982), but evidence has not been found in the Monaro for Pliocene deposition (Ride et al. 1989). The Chalk Pool depositional sequence may indicate this late Pliocene landscape instability. Of the depositional sequence exposed at the Chalk Pool site, a considerably larger river flow than at present would be required for the emplacement of the observed poorly sorted, massive conglomerate deposits. The point bar sequence, for which the best preserved fossils were recovered, has a lack of sediments finer than coarse sand grains, again suggesting a much faster flow than is presently observed.

Until the advent of instability resulting from modern clearing and the introduction of grazing stock (represented by the Terrace 1 deposits), the last cycle of slope instability in the highlands is estimated to have commenced in the Late Pleistocene at around 32 ka (Costin and Polach 1971). This age is in support of the first of the three glacial advance events of the Late Kosciuszko glaciation dated at 32,000± 2500 ka, but not that of the Early Kosciuszko glacial phase between ~55 -65 ka (Barrows et al. in press). The instability associated with decreases in evaporation and increases in run-off, in turn produced larger stream discharge and higher ground-water levels. These culminative effects together with the general cooling and decrease in vegetation (Walker, Nicolls and Gibbons 1983) suggest that slope erosion and sedimentation processes would have increased (Frakes et al. 1987). Dates from solifluction slopes in the Snowy Mountains suggest periglacial conditions at least as low as 1100m by ~26 ky (Costin and Polach 1971). The braided stream deposits of Terrace 3 may represent deposition during this period of hillslope instability; the high discharge being represented in the coarse facies deposited. However, it is unclear from the faunal composition and the state of the fossils recovered from the deposits, whether the species concerned lived during this late part of the Pleistocene, or whether, from their similarity to the Bone Cave deposits of Wellington, they were reworked from older Pleistocene sediments of an earlier climatic cycle. The only dated previous glacial phase in the Kosciuszko Massif was at 59,300± 5400 ka (Barrows et al. in press) and may represent such an earlier event.

The onset of the glacial maximum at ~19 ka (Barrows et al. in press), reduced precipitation and decreased temperature during the summer months (Galloway 1965; Galloway and Jennings 1972). Glaciation was confined to the highest peaks of the Snowy Mountains (Galloway 1963; Barrows et al. in press.). Periglacial activity was much more widespread reaching elevations possibly as low as 600 m (Galloway 1965), concomitant with a lowering of the treeline to about 1400 m, and possibly lower (eg. 600 m, Singh and Geissler 1985), and an interpreted temperature depression of 8-10 degrees relative to the present (Galloway 1965, Singh and Geissler 1985).

A dry climatic phase would have decreased the amount of run-off through the river channels and produced extensive alluvial fans and plains (Walker and Butler 1983) as is observed in the modern topography of the catchment. This is evidenced in the deflation of the lake basins of the Monaro (Pillans and Walker 1995). At this time, the basalt plateau of the southern Monaro would have become a treeless, cold, dry tableland vegetated by a cold open grassland (Hope, 1984).

By 15 ka the severe glacial stresses had passed and the Kosciuszko region deglaciated (Costin 1972). A transitional phase in hydrology is correlated with a change in climate between 15 and 13 ka (Bowler et al. 1976) linked with a brief lake-full phase at Lake George (Galloway 1967). Any terrace building associated with Terrace 3 had long since passed and the initiation of modern rivers quite unlike those of the past began. Teapot Creek is inferred to have changed from a braided river to a meandering stream/creek. Deposition during this transition has not been stratigraphically recorded. Instead the stabilisation of the catchment and minor erosion of Terrace 3 sediments would have taken place during these dry conditions.

With the termination of the cold conditions, re-vegetation of the slopes stabilised the previously mobile mantle, in turn the development of soil proceeded. Distal colluvial deposits would have started to develop on top of the valley terraces upstream. Proximal colluvium would have been stabilised to a certain degree and the alluvial fans may have stopped forming.

Between 8 and 5 ka it is believed a wet period occurred, and the present treeline in the highlands was established (Bowler et al. 1976; Ride et al. 1989). Lake sediments from shallow lake basins in the Monaro indicate that high lake levels were established; these have ^{14}C dates of between 2 and 11 ka BP (Pillans and Walker, 1995). Terrace 2 was probably formed during this phase, where the transport capacity of the creek was increased and the plains, modified by a much lower runoff, were eroded (Walker and Butler 1983). A meandering depositional regime is inferred from Sites 3 to 7 (and for Terrace 2 deposits at Site 1 and 2, Fig 2a). Terraces similar to those of Terrace 2 are widely recorded in the southeastern Highlands (Walker and Butler 1983; Prosser 1987; Ride et al. 1989; Davis 1996) they have prairie-like soils, are set into higher terraces and date from about 11 to 3 ka. In particular, the ages from Terrace 2 correspond with those of comparable units in the northern Monaro Pilot Creek sequence; units PCB at 6380 ± 230 years BP and PCLB at 4600 ± 120 years BP (Ride et al. 1989; Davis 1996). Sedimentological records indicate an increase in rich carbonaceous soils occurred during this time (Taylor 1994). Deposition of this terrace began around 6-5 ka, as suggested from ^{14}C dating at Site 2.

Faunal remains in Terrace 2 deposits, and in deposits of similar age in the northern Monaro (Davis, 1996) do not indicate that any species characteristic of the "Pleistocene megafauna" became reestablished in the climatic amelioration in the Monaro that followed the last glaciation. The faunal content of Terrace 2 is too slight to enable us to determine whether a fauna not unlike that of modern-day Tasmania developed after the last glacial maximum as it did in the northern Monaro (Ride et al, 1989); there is no indication, either, whether the differences in elevation of these southern and northern Monaro sites (i.e., Teapot Creek, between 770-1000 m, as compared with the deposits of

Pilot Creek, near Cooma, at between 800-905 m) placed constraints on faunistic events, but it is probable that Teapot Creek remained climatically and environmentally inhospitable to most large mammals requiring cover until around 8 ka when the tree line is thought to have re-established and the highlands became more habitable (Bowler et al. 1976, Singh et al. 1981). The Monaro rainshadow may also have had a more marked effect in Teapot Creek than at Pilot Creek during this period. Further decreases in the Lake George levels (Coventry 1976) indicates that the late Pleistocene cool climate eventually gave way to the warmer and drier conditions present today. This correlates with the continued decrease in stream discharge recorded at Teapot Creek and the more recent reactivation of deflation of the Monaro lake basins (Pillans and Walker 1995). On these grounds Terrace 1 is regarded as representing most recent sedimentation.

SUMMARY

The sequence of sedimentary fossil-bearing terraces of Teapot Creek overlies a basement of Palaeocene lake sediments. These lacustrine sediments are a part of the Lake Bungarby deposition identified by Taylor et al. (1990). They interfinger with overlying basalts, which provide the main source material for the subsequent alluvial and fluvial deposits in the valley.

The sequence of alluvial deposits that infill the lower reaches of Teapot Creek are represented by two low alluvial benches (Terraces 1 and 2) which are relatively close to the current creek. Terrace 2 appears to have been deposited in a meandering depositional regime and occurs as a higher level flood plain as the terrace is followed up-stream. Remnants of Terrace 2 are recorded at Sites 1 and 2. The only true abandoned terrace above the flood plain of Terrace 1 and 2, is Terrace 3. Terrace 3 is identified as a channel fill terrace. Its deposits are correlated by facies, elevation and the occurrence of similar fossil material.

It is suggested that progressive lowering of the alluvial landscape, producing these terraces, resulted from a reduction of stream discharge affected by the change in climate. The only ^{14}C date resulting from this study indicates that deposition of Terrace 2 occurred between 5 ka and the present.

Stratigraphic description of Terrace 3 suggests that in its lower part, between Sites 3 and 7, it was deposited in a meandering depositional regime. Upstream, between Sites 9 and 16 it became a braided stream which deposited many structureless longitudinal bars. These accreted vertically and are observed in section as massive, gravelly beds.

The fossils recovered and identified indicate the fauna was typical of the Pleistocene and composed of grazing/browsing herbivores dominated by the large kangaroo, *Macropus titan*. Bias in the sampling is thought to have occurred, with selective accumulation of more robust fragments of larger mammals, which were able to withstand the high flow regime mode of deposition in the conglomerate deposits. Faunal change occurred between the end of deposition of Terrace 3 and the deposition of Terrace 2 (i.e. between 25 and 6 ka) but it is unclear whether the species represented in the Terrace 3 deposits are of the same age as the deposits or are derived from an earlier pre-existing Pleistocene deposit. The species composition of the Terrace 3 deposits is comparable with that of the fauna of Bone Cave, Wellington Caves, which is possibly of early Pleistocene age.

The Teapot Creek deposits are considered to show several depositional regimes affected by a seasonal arid climate where weathering, erosion, deposition and mantle instability predominate. Decreasing stream discharge and change in depositional scenarios from braided to entrenched meander are correlated and interpreted from inferred climatic changes.

In the valley of the MacLaughlin River, close to its junction with Teapot Creek, a site known as Chalk Pool contains deposits not unlike those described for Terrace 3 but the fossils are less fragmented and include species (*Protemnodon chinchillaensis* and *Macropus pan*) known only from Pliocene deposits elsewhere.

ACKNOWLEDGMENTS

Funding of the work presented in this paper was provided by ARC grant no. A38931619 to W.D.L. Ride and G. Taylor for research on the mammal-bearing deposits on the eastern highlands and presents the results of Dr Armand's Honours research at the Australian National University during 1991-1992. We are grateful to John Bridgewater and David Bright for providing access to their properties, and the Walder family for their enthusiasm and hospitality to Leanne Armand during her extensive fieldwork. Angela Davis, Tim Barrows, Ken Campbell, Gavin Prideaux, Peter Murray, Alex Baynes, Richard Barwick and Henk Godthelp are thanked for their very helpful discussions and advice during study and preparation of the manuscript, as are the curators and collection managers of the various collections mentioned in the text. Dr Brad Pillans kindly extracted and processed the palaeomagnetic samples. We thank our two annoymous reviewers for comments that improved the manuscript. Dr M. Ricard and Prof. R. Arculus are thanked for supporting us with the facilities of the Geology Department, A.N.U. Enquiries regarding the fossil collection should be directed in the first instance to David Ride or the curator of the collections of the Geology Department, ANU.

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APPENDIX

Identifications are based on the characters of the following specimens (voucher specimens). Other, more fragmentary, but identified, material is not listed, but the total number of each species (including these more fragmentary specimens) is given in parenthesis after each listing. Specimens in museum collections compared and regarded by us as conspecific with the Teapot Creek specimens are listed by prefixes and specimen numbers of those collections (AM = Australian Museum; ANWC = Australian National Wildlife Collection, CSIRO; NHM = Natural History Museum, London; SAM = South Australian Museum, QM. = Queensland Museum). Collection numbers listed for MacLaughlin River specimens are those recorded in Dansie (1992). A bibliographic reference is given to the original descriptions of each species followed by its type locality (in parenthesis) and then by other references to descriptions used to identify the voucher specimen(s).

The dental nomenclature employed follows Ride (1993) and is that of Flower (1867), confirmed embryologically by Luckett (1993); cusp homologies of molars follow Tedford and Woodburne (1987) and Ride (1993).

MARSUPIALIA

Macropodidae

Macropus altus Owen, 1874a (Wellington Valley, NSW). Owen, 1877a, vol.1, pp.413-14, vol.2, pl.,82, fig. 1; Bartholomai, 1975 pp. 207,8, pl 12.
Voucher specimen: AMF. 115301, enamel cap of right P^3, posterior part to tip of anterior cusp

(paraconid) present, remainder broken off (920114-02), Teapot Creek, Site 17.
Compared and considered conspecific with NHM M10779 (holotype, P^3 extracted from crypt).

Macropus ferragus Owen, 1874b (Pleistocene of the Condamine River, Qld). Owen, 1877a, vol.1, pp.449-51 (including *Leptosiagon gracilis*), vol.2, pl.,96, fig.4, pl.,97, figs 3,4, pl.,105, fig.3 (*L. gracilis* pl., 89 figs 11-15); Bartholomai, 1975, pp210-212, pl., 15.
Voucher specimen: AMF. 115302, broken left mandibular ramus from masseteric foramen and small portion of ascending ramus to posterior edge of symphyseal rugosity, M_{2-4} (M_4 complete, M_2 and M_3 are heavily worn, broken and mostly missing); ramus found in fragments but reconstructed (8788-12), Teapot Creek, Site 15.
Compared and considered conspecific with NHM 32903 (holotype), 40005 (holotype of *L. gracilis*), QM F4059 (=OC no.6996), F4056 (=OC no. 11422)

Macropus giganteus Shaw, 1790 (Kings Plains, Cooktown, Qld) **or *M. robustus*** Gould, 1841 ("mountain tops on the interior of N.S.W.").
Voucher specimen: AMF.115303, part of right innominate bone consisting of the acetabulum and parts of the ischium, pubis; and ilium including the precotylar tuberosity (910928-01), Teapot Creek, Site 2.
Compared with and not separable from modern specimens of *M. giganteus* (ANWC M.11033) and *M. robustus* (ANWC M.11042)

Macropus pan (De Vis, 1895) (Darling Downs, Qld, probably Chinchilla). Bartholomai, 1975, pp., 214-216, pls 17, 18; Flannery, 1984, pp., 123 (fig.,2),124.
Voucher specimens: AMF.115304, right mandibular fragment with M_3 (M_4 in crypt visible in radiograph) (920718-03), Chalk Pool, MacLaughlin R.; AMF.115305, left mandibular ramus complete from I_1 to anterior edge of ascending ramus with I_1, P_2, dP_3, M_1, (920606-07), Chalk Pool, MacLaughlin R.
Compared and considered conspecific with QM F3715 (Chinchilla, Qld), F3717 (Chinchilla, Qld), F3713 (Chinchilla, Qld).

Macropus titan Owen, 1838 (large cavern, Wellington Caves). Owen, 1877a, vol.1, pp.400-408, vol.2, pl.,82, figs 17,18; Bartholomai, 1975, pp.,199-202, pls 7-10.
Voucher specimens: AMF.115306, fragment of right maxilla with root of zygoma and P^2 (P^3 excavated from crypt), dP^3, M^1, (930126-34), Teapot Creek, Site 4; AMF.115307, anterior part of left mandibular ramus with I_1, dP_3, M_1 (8788-08) Teapot Creek, Site 7; AMF.115308, fragment of right ramus with M_{2-4} and detached diastemal fragment (8788-03) Teapot Creek, Site 4.
Compared and considered conspecific with QM, F645 (Pilton, Darling Downs, Qld, lectotype of *M. magister* De Vis), F4552 (=C167) (Clifton, Darling Downs, Qld); NHM, M10777 (*M. titan* holotype); AM, F88500 (=MF41) (topotypical), F30518 (topotypical), MF131 (topotypical).

Procoptodon goliah (Owen, 1845), ("newer Tertiary deposits", Darling Downs, Qld). Tedford, 1967, pp., 66-69, fig. 18 a-c; Murray, 1991, p. 1115, fig.26g.
Voucher specimen: AMF.115309, proximal portion of left femur; the head missing from the neck, and the greater tuberosity also missing; the shaft is sharply fractured away 6-7 cms distal to the posteromesial tuberosity ("hind tuberosity" of Owen, 1876, p.437 and pl.81, fig.2p, and "large circular rugosity" for the "insertion of the quadratus femoris" muscle of Wells and Tedford, 1995, pp.59,60, fig.32g) (911112-01), Teapot Creek, Site 4.
Identification confirmed by. P. Murray (pers. com. with L. Dansie, 1991).

Procoptodon pusio Owen, 1874b (probably Gowrie, n^r Drayton, Darling Downs, Qld). Owen, 1877a, vol.1, pp.454,5, vol.2, pl.,90, figs 2-7; Bartholomai, 1970, pp., 224-27, pl., 21
Voucher specimen: AMF.115310, right M^1, worn, paracone and preparacrista eroded away and similarly the metacone and postmetacone crista (920114-01), Teapot Creek, Site 7.
Compared with and considered conspecific with AM F89060 (Bingara, NSW)

Protemnodon anak Owen, 1874a, (Darling Downs, Qld). Owen, 1877a, vol.1, pp.428-30, vol.2, pl.,85, figs 1-4 (figs of anterior molars excessively worn and not helpful); Bartholomai, 1973, pp. 318-24, pl., 12.
Voucher specimen: AMF.115311, left dP_3 and M_1 found together but separated in collecting, both worn and severely abraded (940300-01), Railway Cutting Site; AMF.115317. left M_2 (950421), Teapot Creek, Site7.
Compared and considered conspecific with QM F3051 (Gowrie, Darling Downs, Qld).

Protemnodon chinchillaensis Bartholomai, 1973, pp., 350-2, pl., 20.
Voucher specimen: AMF.115312, portion of maxilla with M1-M3, bone of maxilla broken into fragments and reconstructed (920606-08), Chalk Pool.
Bartholomai (pers comm.) considers that it agrees with *P. chinchillaensis.*

Protemnodon "roechus/brehus" [The two species *Protemnodon roechus* Owen, 1874a (Gowrie, Darling Downs, Qld) *P. brehus* (Owen, 1874a) (Breccia Cave, Wellington Caves) are not separable on the material available to us. Accordingly, we use the apellation *P. "roechus/brehus"* informally in this paper to designate material in that category]. Owen, 1877a, vol.1, pp.434-408, 424-6, vol.2, pl.,87, figs 10-13, 5-9; Bartholomai, 1973 pp. 340-7, pl 16 (*P. roechus* I^1), pl.,18 (*P. roechus* I_1); Davis, 1996, p., 89, pl 3.5, figs 7a,b.
Voucher specimens: AMF.115313, right I_1 (921100-01), Sherwood Stn (site unknown), I_1 considered conspecific with Davis specimen D48828 (Pilot Creek, Yalcowinna Stn, nr Cooma, NSW); AMF.115314, right I^1 (8788-26) Teapot Creek, Site 4, I^1; compared with and considered congeneric with AM MF428 (*P. anak*), but within the size range of *P. roechus* - not *P. anak*; AMF. 115315, left I^3 (920619-04), Chalk Pool; considered conspecific with AM F38785 (7m s.w. of Willowtree near Warrah Creek, NSW) and QM F5053 (eastern Darling Downs).

Sthenurus andersoni Marcus, 1962 (Bone Camp Gully, Bingara, NSW). Prideaux, 1999, vol.1, pp. 63,4 and pl.3, figs G, O, P.
Voucher specimen: AMF.115316, paired and united premaxillae, with incisors complete (920613-01), Toppings Creek, Sherwood Stn.
Identified by G. Prideaux; compared with SAM P.31877 (Victoria Fossil Cave, SA).

Sthenurus atlas (Owen, 1838),(Wellington Valley, NSW). Owen, 1877a, vol.1, pp., 416, 17, 20; vol.2, pl.82, figs 3,4; Tedford, 1966, pp.,11-14, 62,63.
Voucher specimen: AMF.115370, left dP_3 or M_1 (930126-32), Teapot Creek, Terrace 3, not localized.
Compared and considered conspecific with QM 10205, and AM F29582 (Wellington Caves, NSW).

Sthenurus occidentalis Glauert, 1910 (Mammoth Cave, Margaret River, WA). Tedford, 1966, pp.,32-36.
Voucher specimens: AMF.115318, upper molar (950421-06), Teapot Creek, Site 5.
Compared with and considered conspecific with SAM P16648 (Victoria Fossil Cave, Naracoorte, SA) and P20820 (Green Waterhole Cave, Tantanoola, SA).

Sthenurus newtonae (Prideaux, 2000), (from Pleistocene deposits in southeastern South Australia, western Victoria, northern New South Wales, northern Tasmania, the Nullabor Plain and south-western Australia). Prideaux, 2000, p.2, distribution map.
Voucher specimen: AMF.115319, mandibular fragment with M2 and M3 (911209-01), Teapot Creek, Site 12.
Identified by G. Prideaux (pers. comm. June 1993) and listed among referred specimens by Prideaux, (2000, p.4, but without AMF number).

Troposodon minor (Owen, 1877b) ("shaft of a gold lead in the county of Phillip, New South Wales"). Bartholomai, 1967, pp. 25-32.
Voucher specimens: AMF.115320, part of left M_2 , anterobuccal portion (i.e., protoconid portion of protocristid and anterobuccal cingulum) broken away along the crest of the paracristid (940300-03), Teapot Creek, Site 4; AMF.115321, left M_4, with posterior root present and strongly inclined by relative movement of the crown (940300-02), Teapot Creek, Site 4.
Agrees with and is regarded as conspecific with molars of QM F4448.

Vombatidae

Phascolonus gigas (Owen, 1858). Owen, 1877a, vol.1, pp350,351, vol.2, pls., 61, 62, 65
Voucher specimen: AMF.115322, fragment of molar (920606-07), Teapot Creek, Site 7.
Compared and considered conspecific with AM F87037 and F87038 (both Bingara, NSW).

Diprotontidae

Diprotodontidae *gen.* et *sp.* indet. *Diprotodon* - Owen (1877a), vol.1, pp.224-7, vol.2 pl 32, figs 1,2.; Stirling and Zietz (1906) plate facing p.10; *Zygomaturus* - Scott (1915), p.35, pl.15.
Voucher specimen: AMF.115371, left ilium, margins and tuberosities mostly eroded away as well as the dorsal rim of the acetabulum and sacro-iliac symphysis. Bungarby Creek, Brooklyn Station, nr Bombala, NSW.
Compared with a cast of the Stirling and Zeitz skeleton from Lake Callabonna, SA, in the collection of the National Museum of Australia (formerly in the Institute of Anatomy, Canberra).

EUTHERIA

Muridae

Muridae Incertae sedis

Voucher specimen: tibia (920527-03) Teapot Creek, Site 2.

Carnivora and Artiodactyla

Voucher specimens were not preserved of the following taxa whose remains are present in Terrace 1 sediments and the current river bed:

Vulpes vulpes Linnaeus, 1758
Bos taurus Linnaeus, 1758
Ovis aries Linnaeus, 1758